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Smoothing of Solid DT ICF Targets by Electrical Heating

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Abstract

The roughness of the inner surface of the cryogenic fuel layer inside of inertial confinement fusion (ICF) targets is one of the sources of imperfections which cause implosions to deviate from perfect one-dimensional performance. Reductions in the surface roughness of this fuel layer may be needed to achieve ignition and gain in the National Ignition Facility (NIF), and may improve results in cryogenic experiments on the OMEGA laser. The cryogenic ICF community has demonstrated in previous experiments that a heat flux through the gas-solid interface of hydrogens reduces the intrinsic surface roughness of this interface. We have developed a technique to generate a heat flux across this surface by applying an electric field to the deuterium tritium (DT) vapor in the center of ICF shells. This vapor has a small but significant conductivity due to ionization caused by beta decay of tritium in the vapor and the solid. We will describe experiments using a 1.15 GHz cavity to apply an electric field to frozen DT inside of a sapphire test cell. The cell and cavity geometry allows visual observation of the frozen layers. We find that the resulting heat flux reduces the roughness of the ice surface. In addition, we have measured the electrical conductivity of the DT gas in this geometry.

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